

## **11.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES**

### **11.1 Alternative I. No Action Alternative**

CERCLA requires analysis of the No Action alternative when evaluating alternatives in detail; the no action alternative is used to provide a baseline for comparing other alternatives. Under this alternative, no permanent remedial activities would be implemented. Construction of the Interim Measures has addressed repair of the PSP liner, partial draindown of Pad No.2 and installation of a passive evaporation system. However, meteoric water will continue to increase the solution inventory over time. The inflow from Pad No. 1 (2 gpm) will add approximately 2,880 gpd back into the PSP, as will the inflow from Pad No. 2. This indicates that with inflows from both pads, the PSP would approximate a steady state system (flows in equals evaporation out). This calculation and accompanying assumptions use average rainfall amounts and do not take into account the volume of rain from a single major storm event, which could overwhelm the system and cause an overflow to occur. Therefore, the need for a more permanent solution remains.

In addition, the Interim Measures contain no provisions for significant slope reduction on the pads except to repair damage from erosion. Loss of mining waste and solution containment due to catastrophic slope failure would not be addressed. Consequently, long-term human health and environmental risks associated with on site contamination and loss of solution containment would remain unchanged. There would be no reduction in the toxicity, or mobility of the cyanide solution, and, on an annual basis, the volume of the cyanide solution would actually have a net increase due to the addition of meteoric water to the system. No protection would be provided to the community or the surrounding environment. The costs reflect the continued operation and maintenance of the Interim Measures in perpetuity (30 years).

### **11.2 Alternative 2. Close Heap Leach Pads in Place**

On-site closure would provide for protection of human health and the environment because of the long-term reduction in risk due to loss of solution to the environment and capping of the pads. The volume of the solution would be reduced to the lowest practical level by evaporation or treatment. As the solution inventory is reduced, the ability of the containment on site to prevent

solution loss is enhanced for the short-term. This provides for protection of the community and reduces potential environmental impacts. As the on-site closure alternative components are put in place, the temporary risk reductions become long-term risk reductions as the low permeability caps are put in place. As these systems are completed, any potential for increase in the volume of the solution in inventory is significantly reduced. The risk from intense, brief duration precipitation events is reduced as a source to increase the volume of solution in containment. The main components of this alternative, evaporation of solution, capping the heap leach pads, removing the PSP and regrading and revegetating the site are common practice within the mining/construction industry. It is anticipated that water management and treatment of pad drain down would be required for five years post-cap construction. All the material components of the alternative are readily available within reasonable truck transport distance to the mine. What may prevent this alternative from being implemented are U.S. Department of the Interior regulations prohibiting the disposal of solid waste as well as mining waste or produced waters from mining operations on land administered by the National Park Service.

### **11.3 Alternative 3. Clean Closure of Heap Leach Pads in Place**

The clean closure alternative would require rinsing the contents of the heap leach pads and bioremediation in place to immobilize metals and detoxify cyanide and nitrates until federal and state discharge criteria can be met. This alternative would provide for a long-term and effective reduction in environmental risk. The volume of the solution would be reduced to the lowest practical level by active evaporation and treatment. As the solution inventory is reduced, the ability of the containment on site to prevent solution loss is enhanced for the short-term. This provides for protection of the community and reduces potential environmental impacts. As the clean closure alternative components are put in place, the temporary risk reductions become long-term risk reductions as the low permeability caps are put in place. As these systems are completed, any potential for increase in the volume of the solution in inventory is significantly reduced. The risk from intense, brief duration precipitation events is reduced as a source to increase the volume of solution in containment. The main components of this alternative, rinsing and treating the pads in place, evaporation and treatment of solution, capping the heap leach pads, water management post cap construction, removing the PSP and regrading and revegetating the site are common practice within the mining/construction industry.

One of the benefits of the Clean Closure of the Heap Leach Pads in Place alternative is that it would further reduce the risk to human health and the environment from potentially contaminated materials in the heap leach pads and the process solution. While it is likely that some residual pockets of leach pad material would remain unrinsed within the pads, treatment with the bioremediation treatment system will immobilize the metals present in place, and detoxify the cyanide and nitrates in both the solid pad material and process solution to within compliance levels.

#### Alternative 3a. Clean Closure of Heap Leach Pads in Place and Haul of Material to Pit Repository

The option discussed for this alternative, hauling the treated pad material to the pit, addresses one more site feature of the mine as a whole, the open pit. After reduction of solution through evaporation and application of the bioremediation treatment system, pad materials would be transported to the pit. Preparation of the pit for use as a repository would include the placement of waste rock to 10 feet above the water level in the pit. Pad materials would be treated a second time with bioremediation materials as they are placed in the pit. A low permeability cap would reduce infiltration of meteoric water into treated pad materials. This option would add to the environmental and resource-based benefit of the alternative by reducing the human and ecological risk from the open pit. This option would further reduce the footprint of the mine's impact on the Preserve. The stated purpose for the minerals management regulations (36 C.F.R. Ch. 1, Part 9) of the National Park Service are to insure that the pristine beauty of the units will be preserved for the benefit of present and future generations. While it is not possible that the Morning Star Mine site could be restored to a "pristine" condition, this option to the clean closure alternative would provide additional compliance with the intent of the regulations.

#### **11.4 Alternative 4. Off-site Removal - Landfill**

Off site removal would involve excavating and hauling approximately 2,000,000 tons of heap leach pad material for permanent disposal in a licensed solid waste landfill. This alternative would provide for long-term effective and permanent closure of the two heap leach pads and the PSP. The liquid fraction of the contaminated material would be reduced to the lowest practical level by active evaporation and the solid pad materials and liners hauled off site. This would

result in a total reduction in contaminated materials on the site of 2,000,000 tons of solid waste, and approximately 16,000,000 gallons of solution. The liner of the PSP would be removed for disposal as well. Removal of affected soils under the liner footprint of the pads and the PSP should remove any residual material remaining after the initial excavation activities. This alternative could result in some short-term impacts to the community and the environment in the vicinity of the mine. Increases in truck traffic, concerns regarding dust control, the safety of workers and visitors to the preserve, as well as protection of the flora and fauna near the mine site will need to be addressed. While the volume of material to be handled under this alternative is quite high, once environmental and community issues have been addressed, implementation of this alternative should be very straightforward. Identification of a solid waste facility within a reasonable distance from the mine with adequate capacity to accept the solid waste from the mine could be problematical. The costs reflect the sheer volume of material to be handled and hauled as well as the disposal fee in an appropriately licensed landfill.

#### **11.5 Alternative 5. The 4EM Proposal**

The 4EM work plan proposes to beneficially process leach pad materials and haul the finished product off site. As described in documents submitted to the MNP, solution would be evaporated and pad materials crushed, loaded and hauled for sale as an additive to concrete. Under the 4EM work plan it is not clear how the potential risk to human health and the environment from the heap leach pads would be eliminated. The solution inventory would be reduced through implementation of pumping and evaporative efforts until the desired elevation of solution has been reached and the processing of materials could be started. The levels of nitrates present in the solution will become concentrated as evaporation measures progress. The 4EM discussion of pad detoxification does not refer to the high levels of nitrates in the solution or the potential project delays and expense to treat them. The work plan does not contain specific descriptions of how reduction of toxicity through treatment would be achieved.

While many of the specific details have yet to be engineered, this alternative could provide many of the same advantages as Alternative 4, Off-Site Removal. Off site removal would involve excavating and hauling approximately 2,000,000 tons of heap leach pad material for use as posplan. This alternative would provide for long-term effective and permanent closure of three

facilities at the Morning Star Mine site, the two heap leach pads and the PSP. The liquid fraction of the contaminated material would be reduced to the lowest practical level by active evaporation and the solid pad materials and liners hauled off site. This would result in a total reduction in contaminated materials on the site of 2,000,000 tons of solid waste, and all of the remaining solution. The liner of the PSP would be removed for disposal as well.

This alternative could result in some short-term impacts to the community and the environment in the vicinity of the mine. Increases in truck traffic and impacts to MNP roads, dust control, verification of the safety of the pozzolan during production and for use, as well as protection of the flora and fauna near the mine site are questions that will need to be addressed if this alternative is chosen as the Preferred Alternative. The 4EM Company has calculated that \$1,000,000 in revenue from the sale of the finished product would be available for the MNP to use for reclamation of other portions of the mine site at the end of their operation.